**Objectives**

* Describe how energy drives movement and change in the asthenosphere

**Causal Principles**

1. Gravitational energy, thermal energy and/or chemical **energy** drive all movement and change of matter on Earth.
2. Matter moves and changes to return a system to **equilibrium**.

5. **Temperature** is a measure of the movement of molecules. Higher temperature means molecules are moving faster.

1. When molecules move faster, the **density** of most substances decreases. Water is an anomaly because liquid water is more dense than ice.
2. **Buoyancy** causes materials to rise or fall due to the relative density of materials.

**PART 1: Background Notes**

Include anything here you may want to remember from the introduction to the activity.

**Part 2: Group Work**

\*\*Insert diagram for Asthenosphere Convection. Diagram shows a cartoon of mantle convection (perhaps modified from PPT)

1. Explain why density is such an important concept for asthenosphere convection.
2. Consider the principles listed on the first page. Label the diagram above to indicate where gravitational (G), chemical (C) and thermal (T) energy are driving asthenosphere circulation.
3. What would happen to convection in the asthenosphere if gravity pulled material towards Earth’s surface, rather than towards Earth’s center? Draw a diagram that shows convection on this inverse-gravity world.
4. Imagine that the Earth’s outer layer is made up of material that is denser than the Earth’s asthenosphere, and that the Earth’s core is made up of material that is less dense than Earth’s asthenosphere. What would convection look like on this Earth? Draw a diagram that shows convection under these conditions.

**Part 3 – Homework**

If you complete the group work, you may work on the homework **on your own.** This means your answers should be generally unique from other students’ answers. **Submit your homework using ANGEL**.

**Short Answer Questions**

* What is slab pull?
* Why is density important for slab pull?

**Conclusion Question:**

Was slab pull or convection a more important mechanism for moving tectonic plates 3 billion years ago?

Here’s some relevant information:

* Three billion years ago the earth’s interior was hotter than today because there was more radioactive material and original heat from the Earth’s formation 4.6 billion years ago.
* There were areas of oceanic lithosphere and continental lithosphere three billion years ago.
* Geologists have evidence that there was less continental lithosphere.
* There is evidence that the chemical composition of the oceanic and continental lithosphere were about the same as they are today.

Explain your reasoning.